



The A-mazing Aquifer

This activity center is part of the **Water Protection** theme.

Purpose of this activity?

At this activity centre, there is a model of an *aquifer*, which is any soil through which groundwater moves easily. The model illustrates the subsurface (sand, gravel and bedrock aquifers and *aquitards*) and its relation to the surface water (lakes and rivers). A pump can be used to change the amount of precipitation in the system. Water moves continuously through the model from higher to lower elevation (due to gravity). There are several wells to demonstrate the effect of pumping on an aquifer.

Ensure that students understand the key terms **highlighted** in the activity by using them in several different contexts throughout the presentation.

Key messages:

- Groundwater does not run in underground rivers; it percolates through sand and gravel
- Groundwater is a source of drinking water through wells
- Pollutants on the ground or in lakes will enter groundwater and percolate through it, contaminating drinking water.

Materials

- Aquifer model
- Aquarium pump
- Food colouring

What will I be doing?

Activity Set Up:

Activity will be set up for volunteers, there is an instruction sheet included with model. There is a manual which explains how to run the model.

There is a common aquarium pump, which circulates the water through the model to simulate part of the water cycle. an instruction book will be provided to

explain the set up procedure. Before the students arrive, fill the tank and the pump with water (you will be shown where to get water) and turn the pump on. You will be explaining the model and using food colouring to illustrate the movement of water and pollution through an **aquifer**. Relate the model to the local area, such as the festival site. Link the groundwater to drinking water for those of us who use wells and to water in natural waterways.

Questions to Ask the Students:

Take the syringe with the hose attachment and draw water up from one well (#'s 1, 2, 5, and 6 are best for this)

Q: Where does this water come from?

A: Groundwater is contained in the open pore spaces among the grains of sand. The open space is called **porosity**. Only under very special geologic conditions does groundwater occur as underground rivers, for example in limestone caves.

Q: What is the source of your water?

A: Regardless of whether your water has been bottled or comes from the tap, the original source of water is a natural one. Water can be taken up from a lake or from an aquifer through water well.

Q: Does the water go through the aquitard or aquifer?

A: An aquitard is an *impermeable* bed of materials that prevents the movement of groundwater. An aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt, or clay) from which groundwater can flow through.

Q: In which aquifer does the water travel most quickly?

A: The larger material such as gravel has larger pore spaces between particles, which will allow water to travel quickly, where the smaller material such as silt or

clay will slow down the travel of water due to smaller pore spaces between particles.

Q: What are some examples of contaminants that can get into an aquifer?

A: Viruses and bacteria as microbial contaminants may result from sewage treatment, septic systems and wildlife.

Inorganic contaminants can occur naturally as salts and metals or can result from urban storm water runoff, oil and gas production, mining or farming.

Pesticides and herbicides contamination may result from agriculture or residential uses.

Radioactive contaminants can occur naturally or can result from oil and gas production and mining activities.

Q: What happens when we contaminate just one part of the aquifer?

A: The contaminant (examples above) can be diluted and travel with the water to other main sources of water (ie lakes, rivers), spreading the area of contamination. The negative environmental effects can then be seen in many other habitats and communities.

Q: What can we do to prevent pollution of our groundwater and surface water?

A: As storm drains generally drain directly to lakes, streams, rivers and wetlands it is good practice to keep litter, pet wastes, leaves and debris out of street gutters and storm drains. Apply lawn and garden chemicals (pesticides and herbicides) sparingly and according to directions. Do not dispose of used oil, antifreeze, paints, and other household chemicals by dumping them in storm sewers or drains where they can eventually reach local streams and lakes.

Additional Information:

Water flows through the soil and sedimentary materials of an aquifer the same way that it moves through a sponge; groundwater does NOT flow in underground streams.

Water does NOT flow through and *aquitard* (or *aquiclude*), which is an *impermeable* bed of materials that hinders or prevents groundwater movement.

Impermeable means that water cannot pass through. Granite is an example of an impermeable earth material. This activity relates to the activity *Porosity &*

Permeability. You may want to ask the students if they have visited that activity centre, or suggest that they go there too (Please check to ensure that this activity centre is running at the festival).

Contamination of one site, such as through a well, can affect the entire aquifer. Some examples of contamination are gasoline and other petroleum products, pesticides, including both herbicides (weed killers) and insecticides (bug killers), over fertilization, nitrates, toxic metals (from industry), and human waste from malfunctioning septic systems. It is virtually impossible, and where possible it is extremely expensive and lengthy, to clean up an aquifer. Pollution *prevention* is key to having clean groundwater and surface water!

66% of the Earth's freshwater is found underground. Even in Canada where we seem to have an abundance of lakes and rivers, there is more water underground than there is on the surface! Groundwater recharges lakes and rivers.

The saturated, top layer of soil in an aquifer contains the groundwater that constitutes the *water table*. This is where plants draw most of their water.

Aquifers can dry up completely if we do not conserve water. Ask the students how they conserve water. Ask them for examples of wasting water and for suggestions about solving these problems.

In Ontario, 23% of our population, that's approximately 2 million people, relies on groundwater (water from aquifers) as their home water source. This does not include industries and farms.

What can I do to keep my water clean?

The best way to maintain good water quality is to not pollute your water sources. Properly dispose of wastes, clean up spills if they happen and phone the spills number if you can't clean up the spill. Also follow instruction on chemicals (pesticides and fertilizers) that may be used. This is called pollution prevention and anyone can do this around the home and work place.

"If you don't want to drink it, don't dump it on the ground or down the drain."

What can I do at home?

- Use environmental friendly products.
- If you do buy household hazardous waste (pesticides, paints, etc.), only buy what you need.
- Use local Household Hazardous Waste Days, paint dept and motor oil recycling centres.

- Don't dump household hazardous chemicals.

What can be done at work places?

- Reduce your use of hazardous chemicals.
- Avoid spills by handling and storing chemicals carefully.
- If a spill occurs, call the MOE and the Region Spills, so the spill can be cleaned up quickly.
- Use **Best Management Practices** at work. A Best Management Practice is another way of doing the same task, but it reduces the risk of contamination. An example would be secondary containment around an above ground tank storing chemicals. If a spill occurs, it would be stopped by the container around the tank and will not flow onto the ground.

Clean Up Procedures:

At the end of the day, please run water through the system until the water comes out clear ... this is to clean out any food colouring. Then turn off the pump and empty the tank (You will be shown where to do this). Clean up any water mess and place all activity materials in the crate.

